

Patent Abstracts of Japan

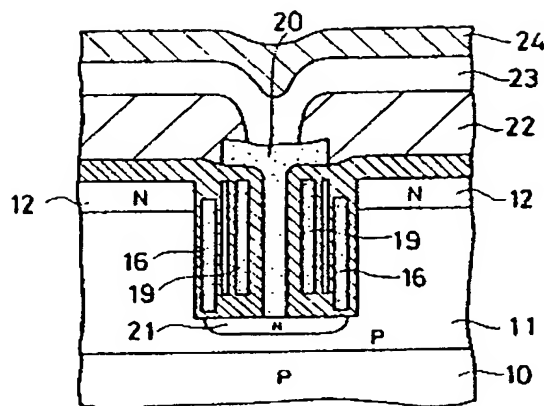
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TITLE : NONVOLATILE SEMICONDUCTOR
 DEVICE AND MANUFACTURE
 THEREOF



ABSTRACT : PURPOSE: To realize a substantially fine structure by a method wherein floating gate electrodes and control gate electrodes are provided on the side walls of a trench formed in a substrate and, further, source or drain regions are provided on the surface of the substrate and a drain or source region is provided on the bottom of the trench.

CONSTITUTION: Floating gate electrodes are provided on a pair of facing vertical side walls in a trench formed in a P-type silicon substrate 10 and, further, control gate electrodes are provided on the floating gate electrodes. Thus, two sets of the floating gate electrodes and the control electrodes are provided on the vertical side walls of the trench. N-type diffused regions 12 provided on the substrate 10 are used as the source regions of two nonvolatile transistors and an N-type diffused region 21 formed on the bottom of the trench is used as the common drain region of the two nonvolatile transistors. The N-type diffused region 21 is connected to an electrode 23 with a polycrystalline silicon film 20. In other words, two nonvolatile transistors are formed in the trench. Moreover, as the source regions and the drain region are separated from each other along the depth direction of the trench, the possibility of creation of a leakage current accompanying the planar fine structure of an element can be avoided. Therefore, the size of the element can be substantially reduced and a substantially fine structure can be realized.

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